GIS SPUTNIK

version 1.0

User manual

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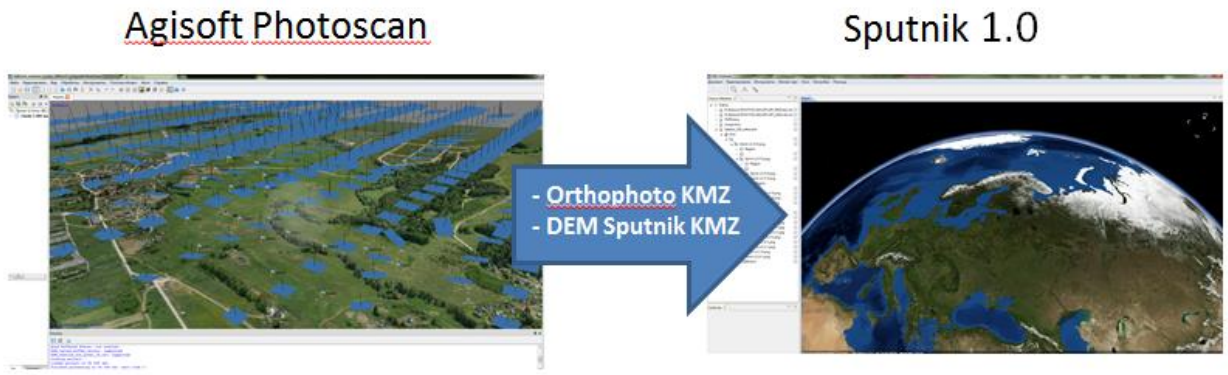
OVERVIEW

Sputnik is a modern geographic information system (GIS). It aimed to provide situational awareness at different application areas and supports number of Open Geospatial Consortium (OGS) standards.

Sputnik is fully compatible with photogrammetric software Agisoft PhotoScan Pro. Uploading orthophoto and DEM generated with PhotoScan is a smooth and easy procedure. Moreover, Sputnik supports PhotoScan LOD-enabled export formats both for photo and elevation model.



With Sputnik you may import orthophoto and DEM without any limitations on file size, coverage area etc. Basic low scale LandSat and SRTM coverage provide a single working space for all users' datasets. Support of OGC standards such as WMS, WFS, KML allows to link Sputnik up with the external GIS-servers.

The main format most often used in Sputnik is KML. It makes possible to upload in Sputnik virtually any data including 3D models, spherical panoramas, various real time sensors data etc.

This manual contains instructions on software installation and starting up, description of application interface and basic tutorials on common workflows.

If you have any comments, reports and recommendations on GIS Sputnik please e-mail us at **sputnik@geoscan.aero**.

INSTALLATION AND STARTUP

System requirements:

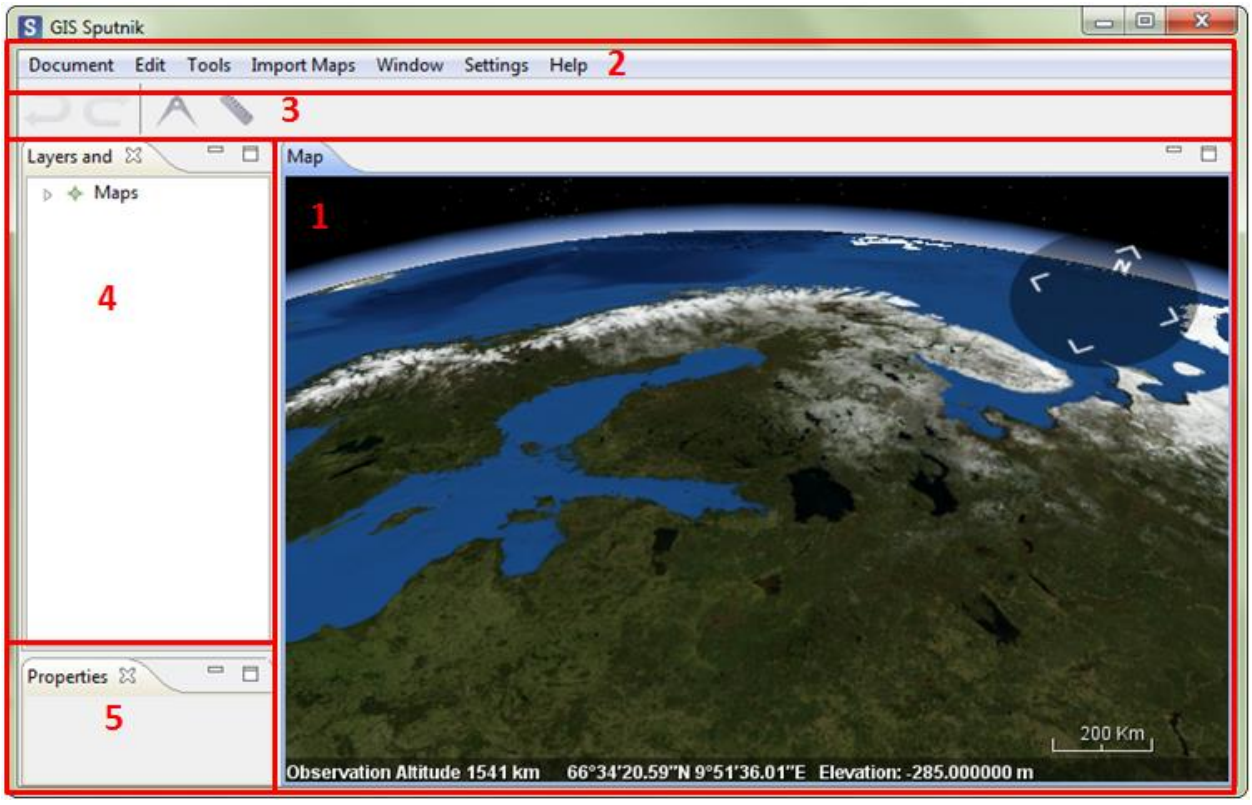
- Windows XP, 7, 8 (32/64-bit)
- 1 Gb HDD free space (used for application files and cached data)
- 2 Gb RAM
- Video: Nvidia, ATI/AMD, Intel HD 4000, 1Gb VRAM

Installation procedure:

- Download installation package from http://www.geoscan.aero/en/gis-sputnik webpage.
- Run installation file Sputnik_1.0…x64.exe (for 64-bit Windows) or Sputnik_1.0…x86.exe (for 32-bit) with administrator privileges.
- Follow onscreen instructions to complete installation.
- After installation is finished, KML and KMZ files will be associated with Sputnik.
- To start application choose it in Windows Start menu: **Start** → Sputnik

GETTING STARTED

When you launch application the main program window appears:



The main parts of application window are Map area (1), User menu (2), Toolbar (3), Layers (4) and Properties (5) panels.

Default basic coverage used in Sputnik is Landsat imagery combined with SRTM elevation model.

When Map view is active you may use keyboard and mouse buttons for navigation on a map:

Navigation options	User action
Scaling (zoom in/zoom out)	Mouse: rotate mouse wheel Keyboard: use “+” and “-” buttons on a keyboard
Moving on a map	Mouse: press left button while on the map and drag to move the map Keyboard: (press left mouse button) and move the map using keyboard cursor keys
Free change of view direction	Mouse: while pressing right mouse button: - move mouse forward and backward — this will change vertical angle of view; - move mouse right and left —this will rotate “virtual camera” around pointed location Keyboard: - <Shift> + Up/Down cursor keys — to change vertical angle of view - <Shift> + Right/Left cursor keys — to rotate camera view
Reset angle to view "top-down" and rotate map to "north-up" view	Press «R» on keyboard
Reset view to "North up"	Press «N» on keyboard

All the user custom maps, elevation and 3D models opened in Sputnik are shown in Layers list. To enable or disable a layer check/uncheck the box near its title.

To rearrange layers order simply drag and drop layer with left mouse button.

TUTORIALS

This section contains short descriptions of loading different types of geospatial data, establishing connection with WMS servers and so on.

Loading orthophoto and DEM generated with Agisoft PhotoScan

Overview

Photoscan Pro software (www.agisoft.com) produces highly accurate 3D models, true orthophoto maps, and digital surface models based on aerial survey data. In PhotoScan it is possible to export all these data types with so called image or model pyramids, i.e. range of lower scale datasets having different level of detail (LOD). Sputnik fully supports this option and allows to load images, elevation and 3D models of unlimited size.

Exporting data in PhotoScan Pro

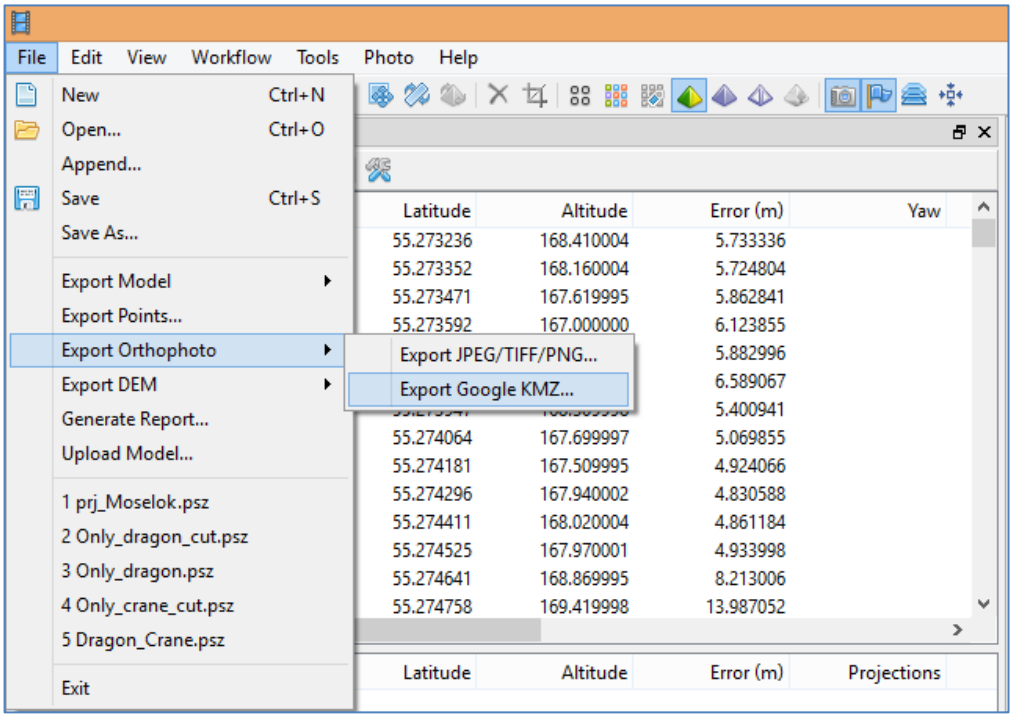
Before uploading orthophoto and DEM to Sputnik it is necessary first to export them from PhotoScan. Currently only KMZ file format allows to enable full support of LOD pyramids.

First:

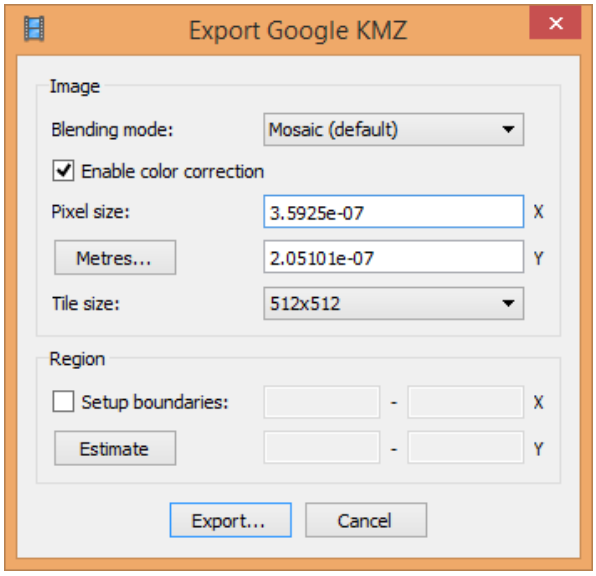
- Make sure you have installed PhotoScan Pro version 0.9.1.1703 or later. If you have an older version, upgrade it. Upgrade package is available at http://www.agisoft.com/downloads/installer/.

To export orthophoto:

- When model is built, export orthophoto in a normal way, but choose KMZ as an output file format (**File** > **Export Orthophoto** > **Export Google KMZ**):



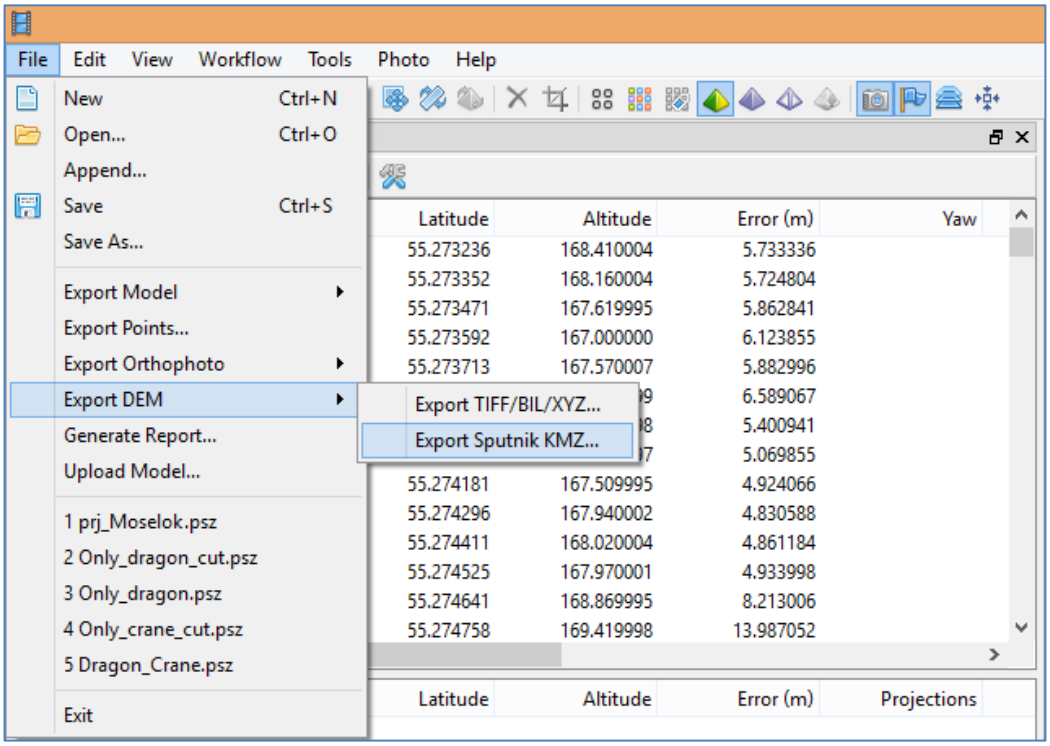
- Set export parameters and press **Export** button:



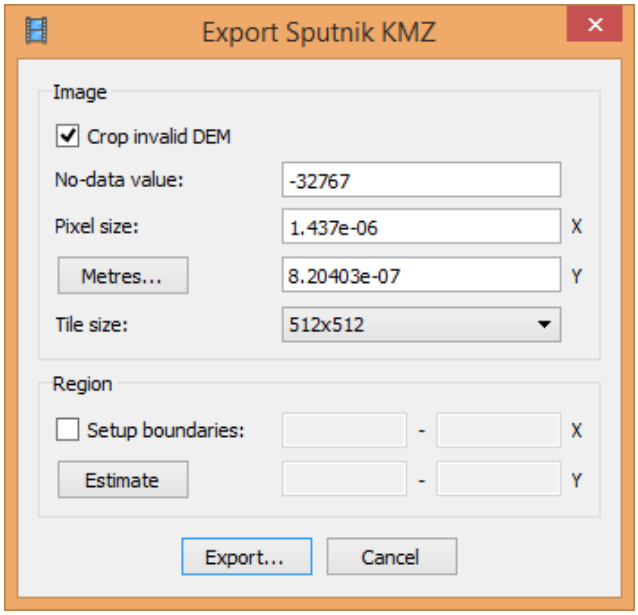
An orthophoto map generated may be loaded and displayed in any geoviewers supporting KML, e.g. Google Earth.

To export elevation model:

- Select **File** > **Export DEM** > **Export Sputnik KMZ**:



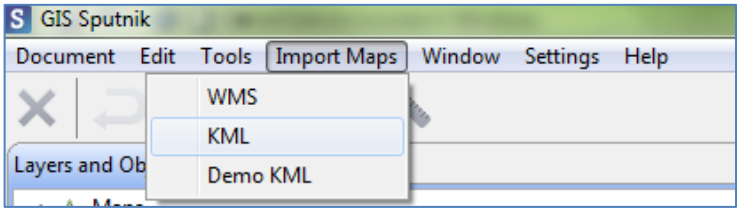
- Set export parameters and press **Export** button:



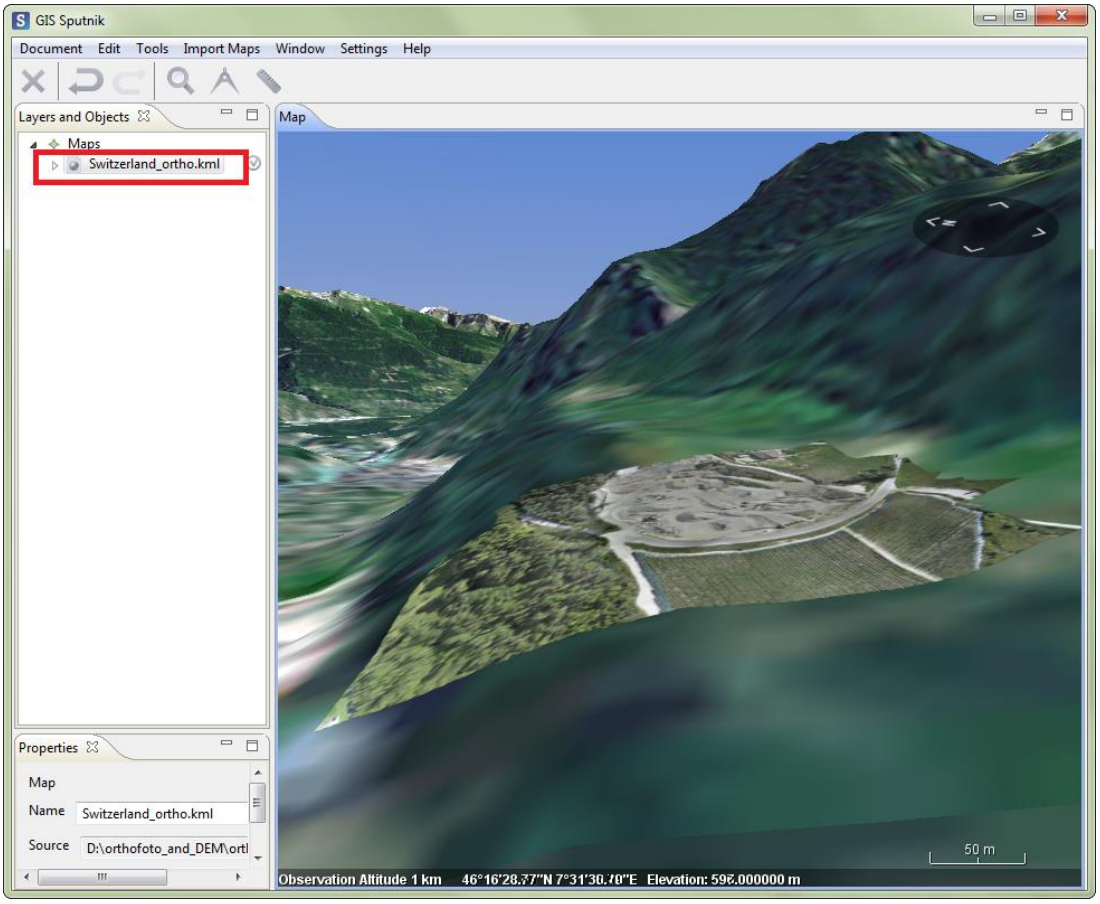
Special extension of KML has been developed by GeoScan team in collaboration with Agisoft to export elevation models in form of pyramid of different LOD mosaic layers.

Loading orthophoto and DEM in Sputnik

- Use your own data or sample data that you may download from ftp://ftp.geoscan.aero/public/Sputnik_demo/orthophoto_and_DEM.zip (118 Mb).
- Unpack archive if you are using sample data.
- To open orthophoto in Sputnik select **Import Maps** > **KML** in user menu and choose orthofoto_and_DEM/quarry_sensefly_orto_27mm_mosaic/Switzerland_ortho.kml:

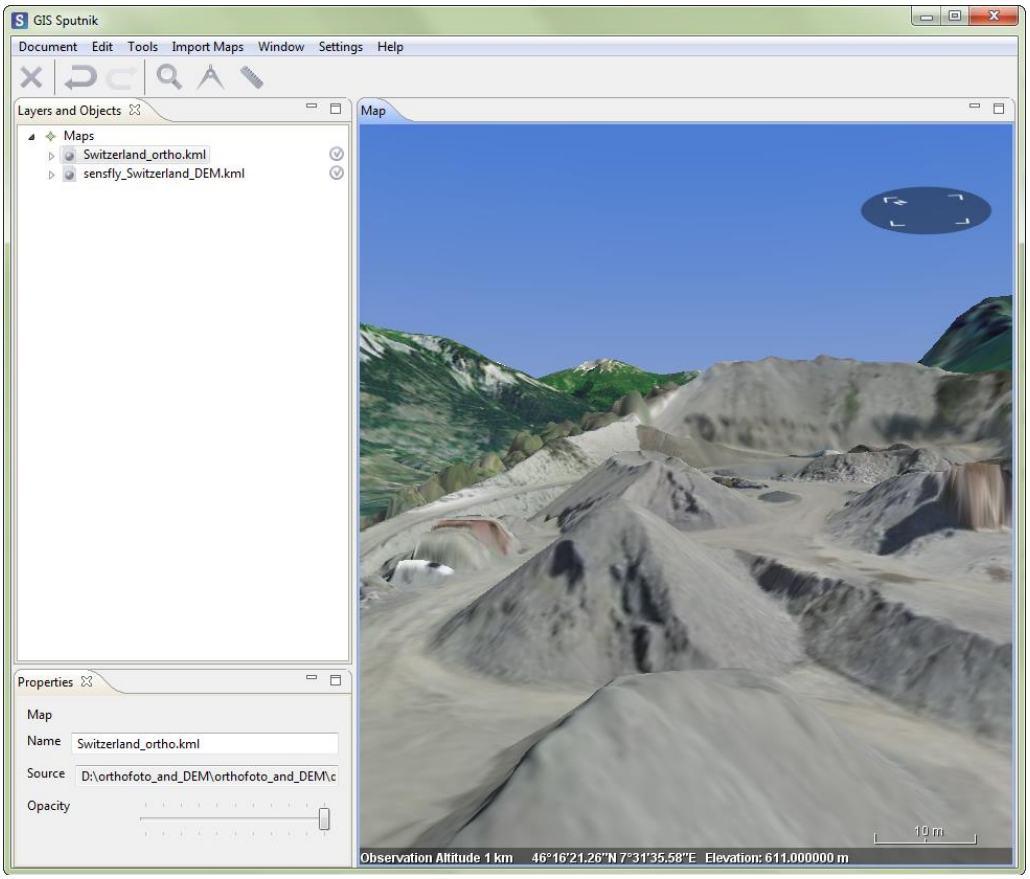


- When orthophoto is loaded new layer appears in "Layers" pane.
- To move map to the location of orthophoto, open Layers tree and double click on Switzerland_ortho.kml.
- Use checkboxes to hide and show layers.
- Zoom map in to view it in details:



Orthophoto loaded will be aligned with default SRTM elevation model. SRTM terrain data have areal resolution 90 m and vertical accuracy about 1 m. To have more detailed surface model load your own DEM. Loading DEM is performed in the same way as loading orthophoto:

Select **Import Maps** > **KML** in user menu and choose:
orthofoto_and_DEM/quarry_sensefly_DEM_90mm/sensfly_Switzerland_DEM.kml:



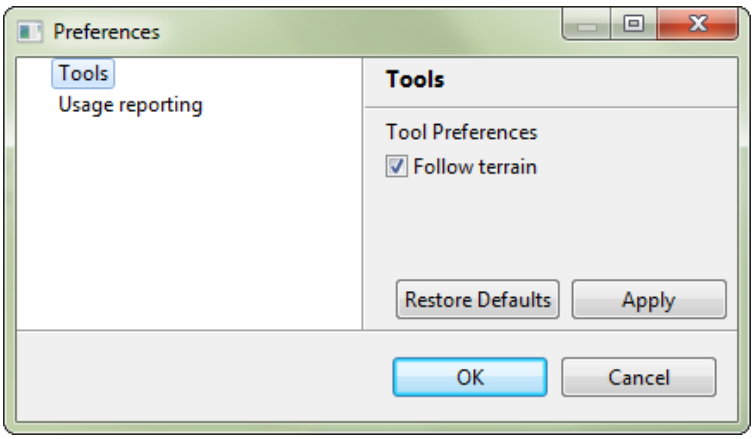
Now both local orthophoto and local DEM are loaded and you may browse them from above and from the ground level, and analyze using built-in tools.

Measurement tools

There are few basic measurement tools in Sputnik that allow to measure heights and distances.

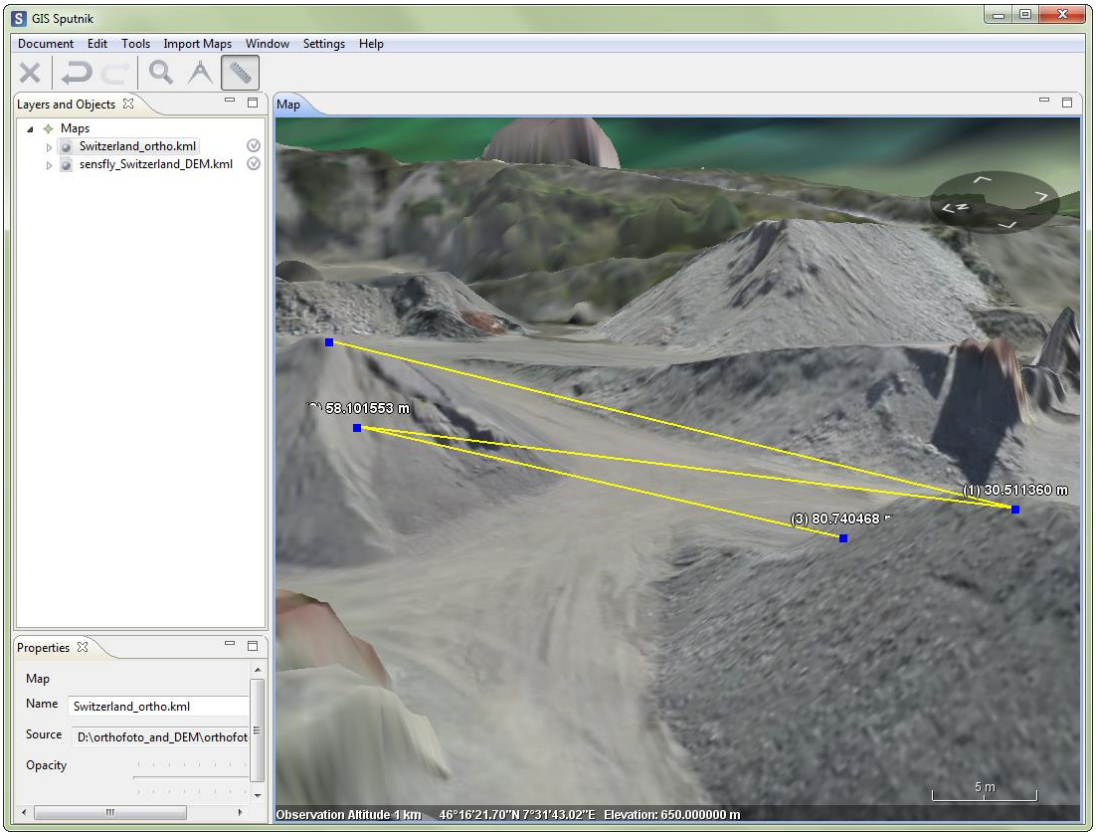
Ruler

Ruler is a tool to measure distances. It may work in two different modes — either calculates straight line distance between two points or measure the shortest path between these points following terrain. The former is default option. To enable the latter you need to check **Follow terrain** option in **Settings** > **Preferences** user menu.

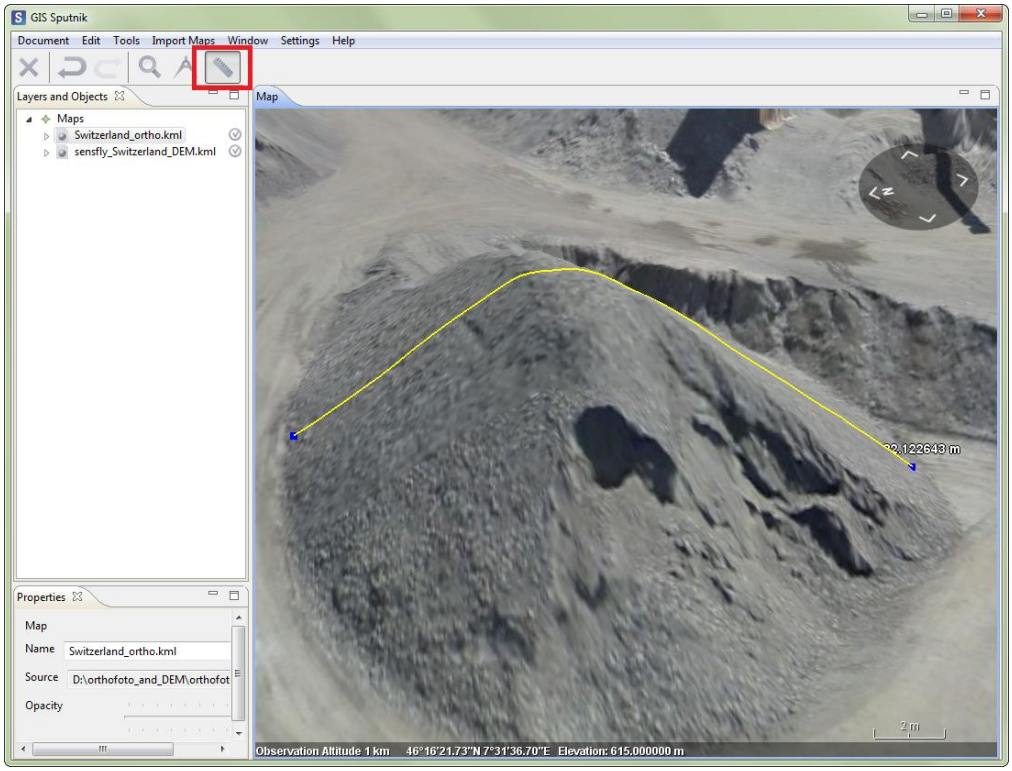


To perform a measurement, select Ruler on tool panel, then click on a map to mark a path. Balloon at each point shows its distance from the starting point.

In straight mode:



And in follow terrain mode:



To move a point, simply drag it with left mouse button.

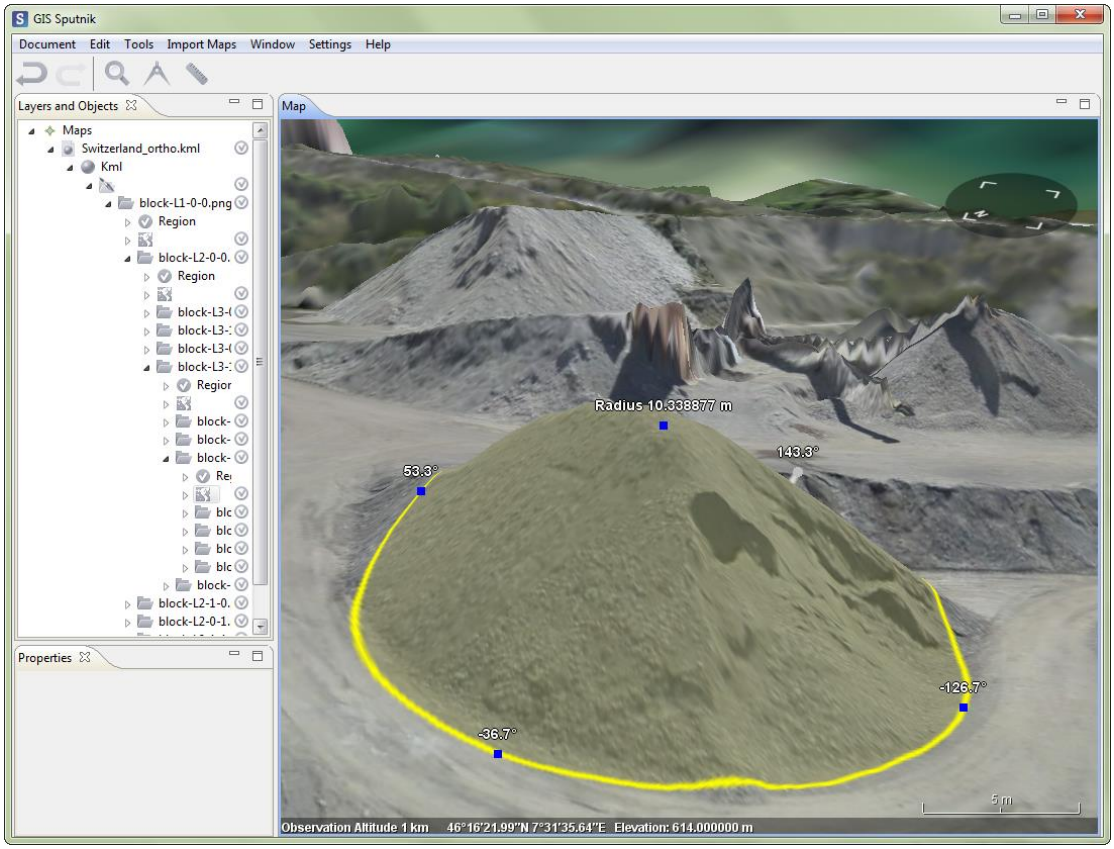
To stop marking a path, place the last point using right mouse button.

Circle

Circle measurement tool allows to display a circle on a map and measure its radius. It might be useful for simple approximation.

To measure radius:

- Select on tool panel.
- Place a point on a map with left mouse button. This point is a circle center.
- Dragging blue square mark change circle radius.
- To move circle drag its central point.



Volume measurement in Sputnik

Overview

Volume measurement tool automates measurements of changing surface features. It allows to calculate both positive and negative deviation of one digital surface model in comparison with another within selected area. Currently Agisoft PhotoScan generated DEM (GeoTIFF tiles in kml/kmz) is supported

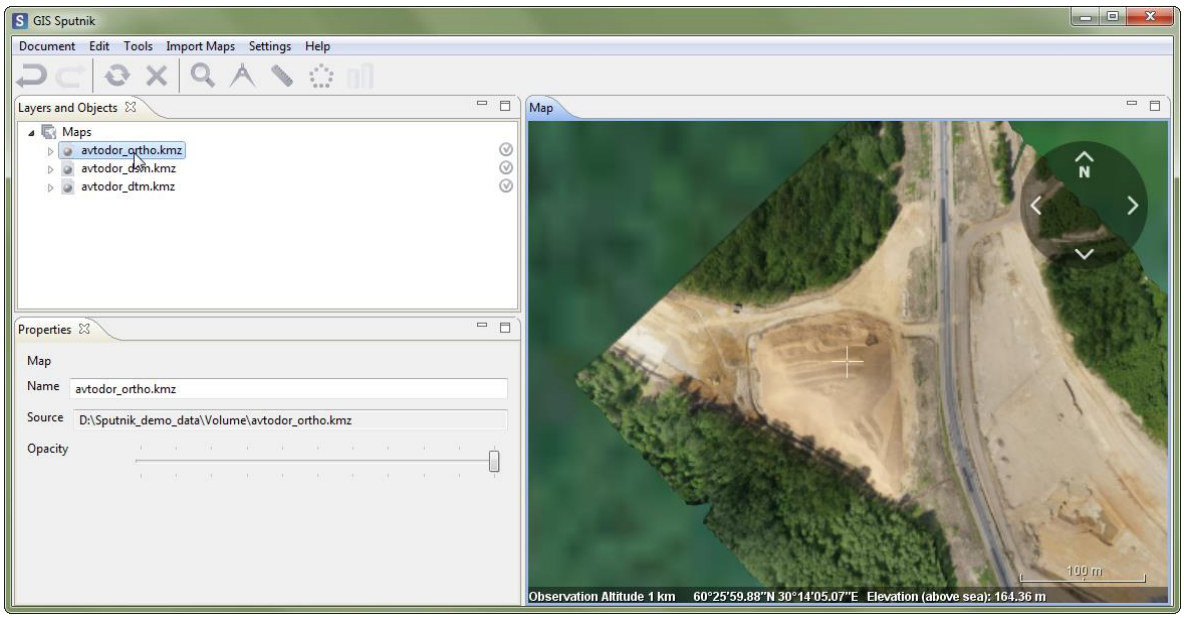
Demo data:

- DEM#0 — ftp.geoscan.aero/public/Sputnik_demo/Volume/avtodor_dem0.kmz
- DEM#1 — ftp.geoscan.aero/public/Sputnik_demo/Volume/avtodor_dem1.kmz
- Orthophoto — ftp.geoscan.aero/public/Sputnik_demo/Volume/avtodor_ortho.kmz

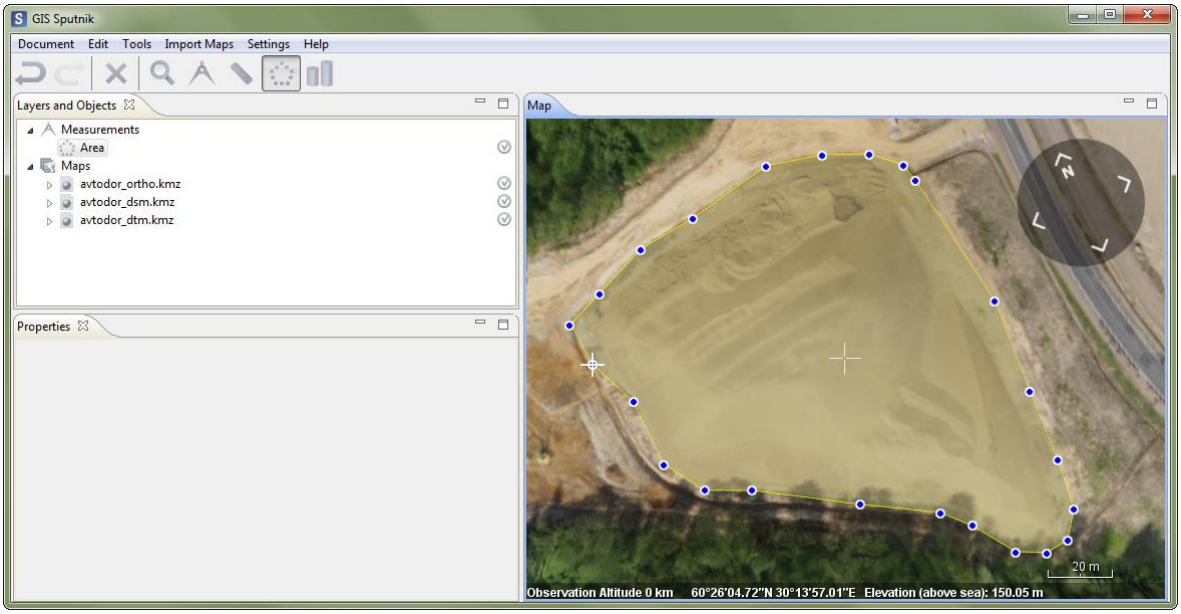
Download data to local file storage.

Basic tutorial

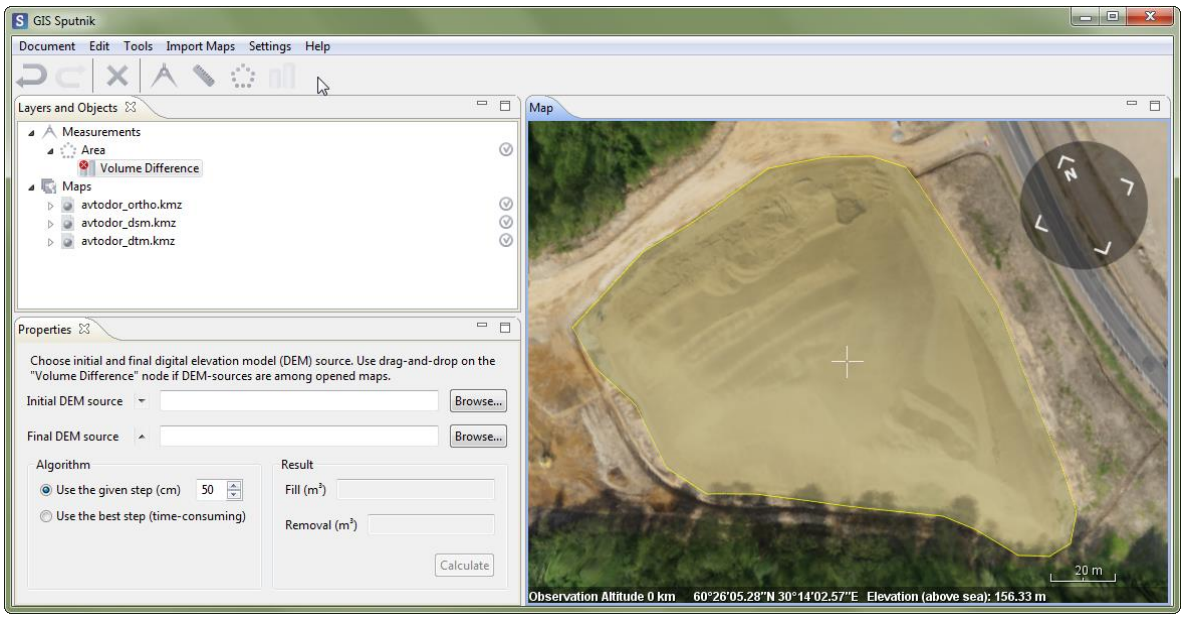
- Run Sputnik Pro
- Open data files:
    - Choose Document > Open in program menu
    - Select file and press Open button
    - Repeat previous steps to open all demo files
    - Loaded files are displayed in "Layers and Objects" pane. While data loading and processing a stop watch icon is displayed at the file name
    - Double click on file name to position map on area of interest

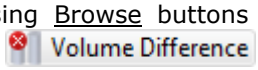


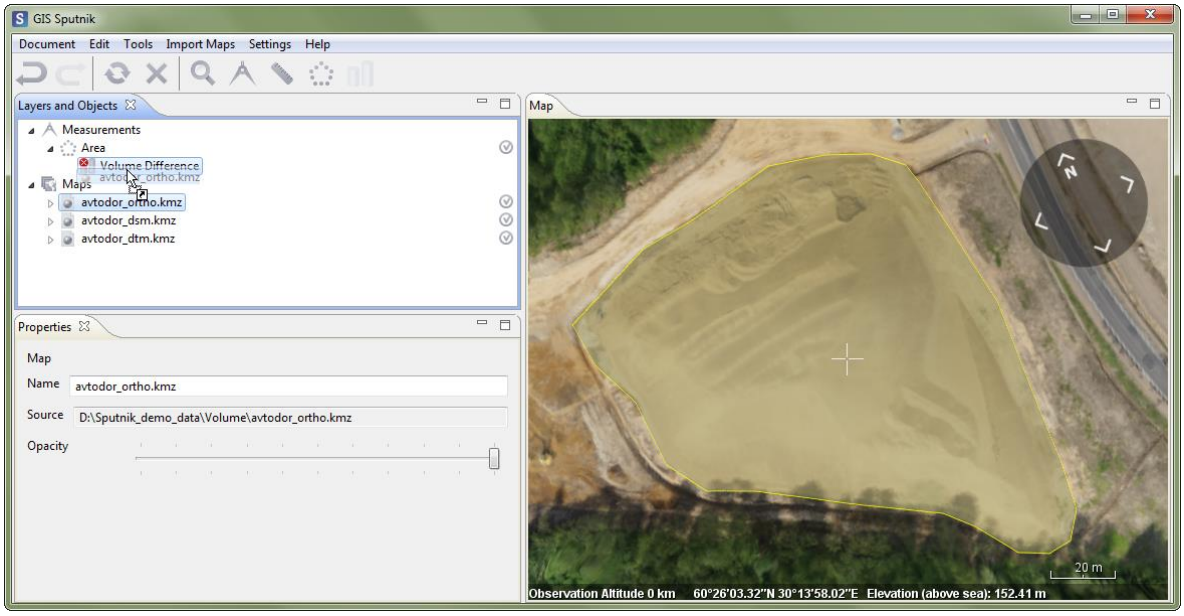
- Mark an area for volume difference measurement:
  - Click button on tool pane to activate “Select an area” tool
  - Set polygon vertex on a map



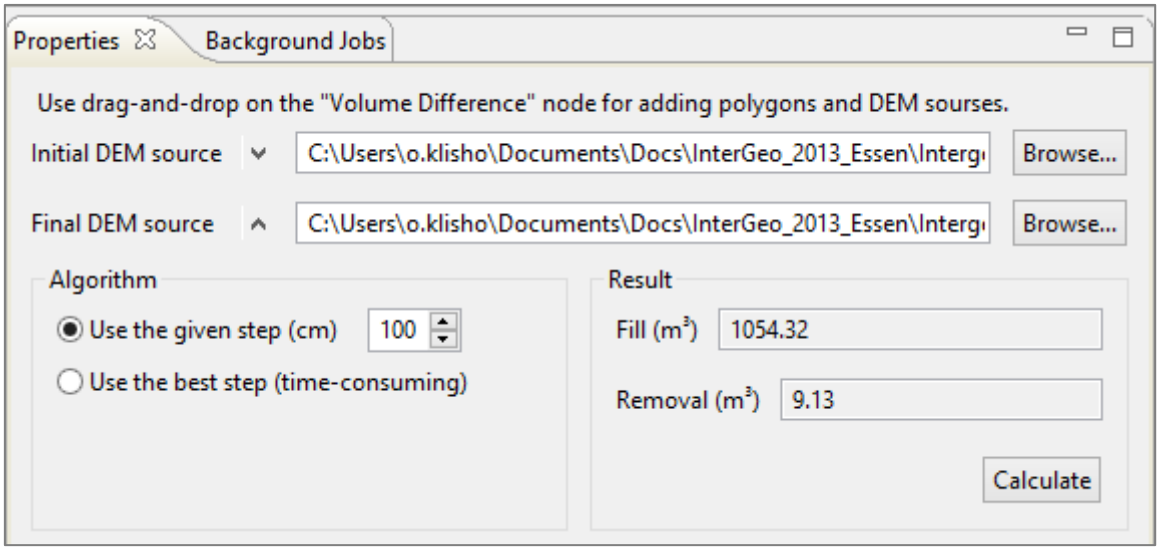
- Calculate volume difference:
  - When polygon is build click button to actvate “Volume difference” tool. It will add “Volume difference” child element to selected area in “Layers and objects” list



- Select initial and final DEMs using Browse buttons and Open file dialog or simply by dragging corresponding layers to  element



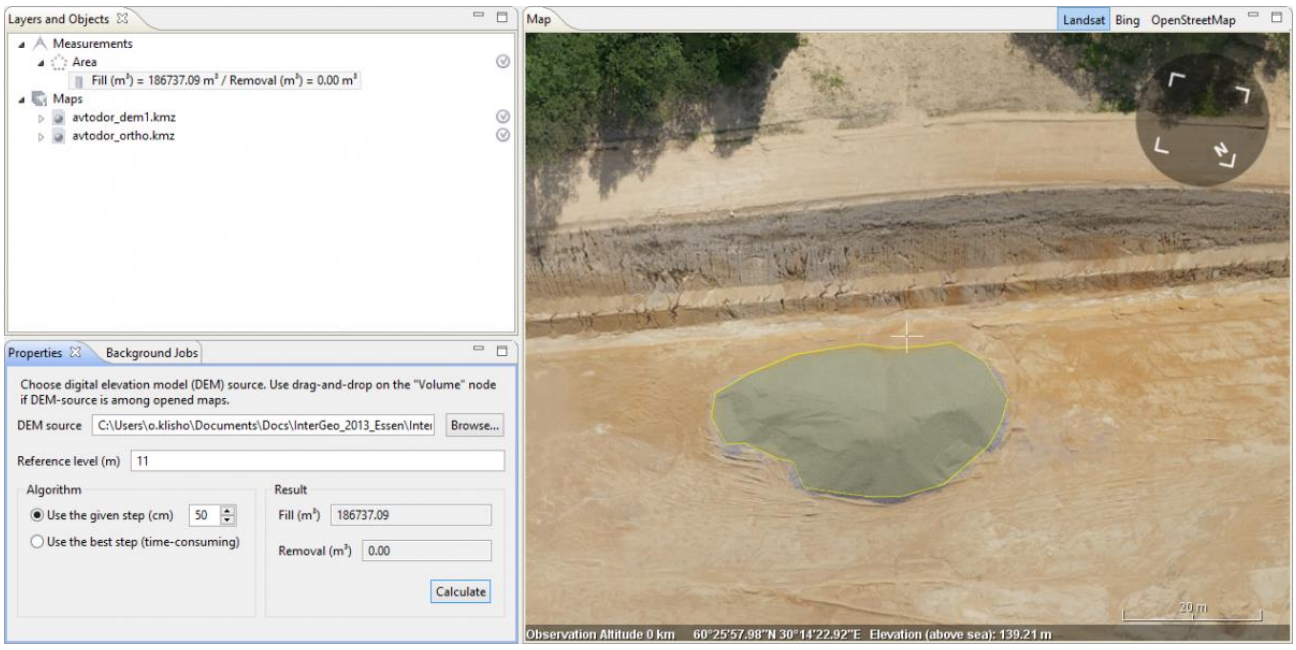
- When both DEM selected press Calculate button. Calculation may take a while. When it is over the results will be shown in corresponding section on the "Properties" pane



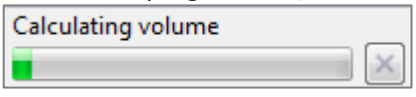
- User may set fixed grid size for volume caclutaions using "Use the given step" and "Use the best step" options in "Algorightm" section. The former lets user set grid step manually, the latter uses native DEM resolution
- Arrows at "Initial…" and "Final DEM source" let quickly reverse order of two DEMs in case they've been loaded in wrong order.

- Calculating volume from reference level

  - After building the polygon press to activate the Volume tool. It will add "Volume" child element to the selected "Area" element in "Layers and Objects" list.
  - Select initial DEM source using Browse button and Open file dialog in "Properties" pane or simply by dragging the corresponding layer to the Volume element in "Layers and Objects" pane:



  - Set the Reference level you want to calculate difference from. If the reference level isn't set, the height of the lowest polygon boundary point will be used by default.
  - Press Calculate button after DEM and Reference level are selected, calculation may take a while, you can follow the process with the progress bar, that will occur in the right top corner:



- You may set fixed grid size for volume calculations using "Use the given step" and "Use the best step" options in "Algorithm" section. The former lets user set grid step manually, the latter uses native DEM resolution.
- After calculations are finished the positive deviations from the Reference level will be shown in the "Fill" field and negative – in the field "Removal".

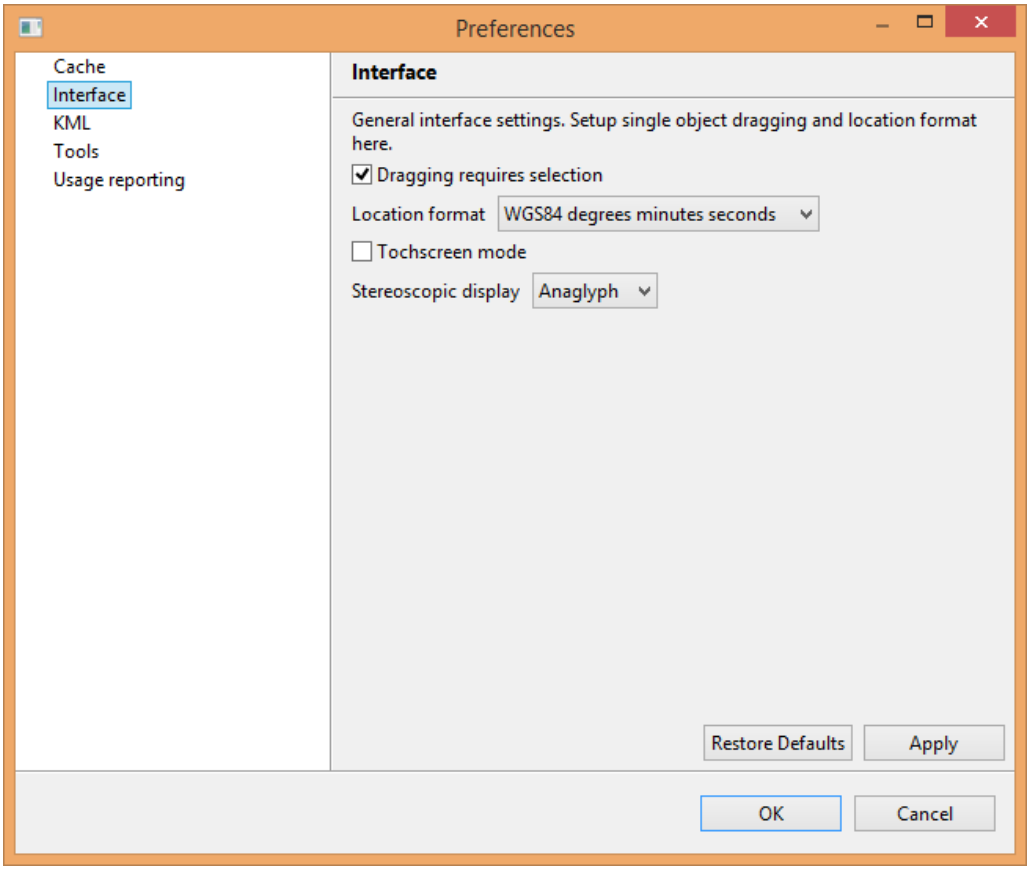
Stereoscopic display

Overview

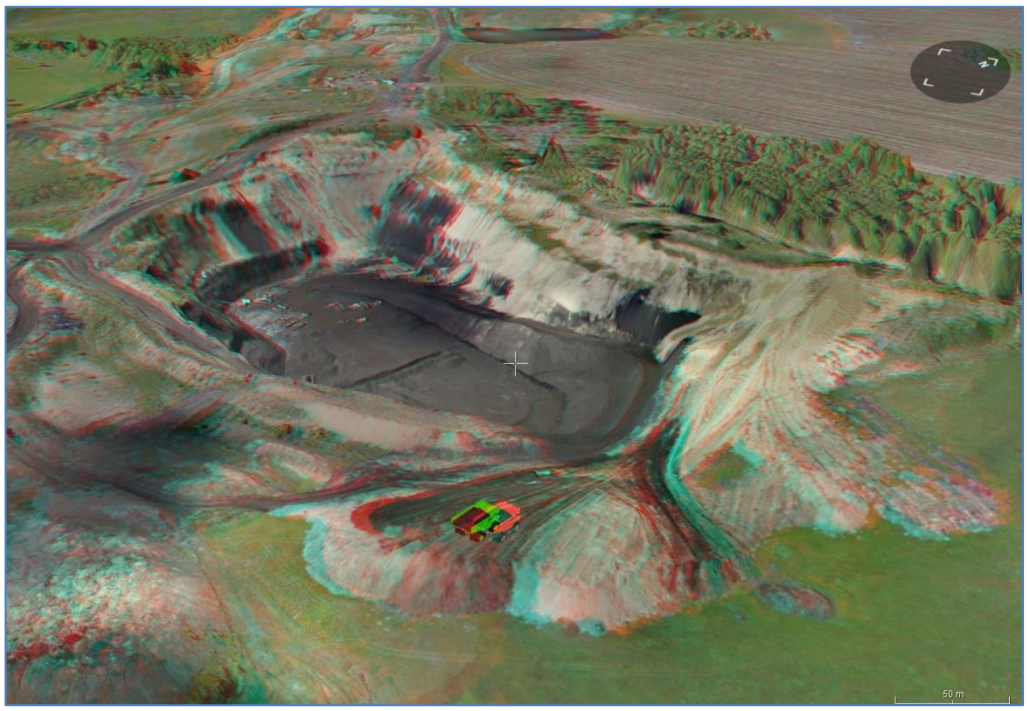
In Sputnik it is possible to activate *Anaglyph* visualization mode. Anaglyph 3D image contains two differently filtered colored images, its viewing through anaglyph glasses reveals the stereoscopic 3D effect.

Workflow

- Select **Settings** > **Preferences** on the top pane.
- Select **Interface** section.
- Select *Anaglyph* mode in **Stereoscopic display** scroll bar.



- To get the stereoscopic 3D effect view the image through anaglyph glasses.



Loading 3D models generated in Agisoft Photoscan

Overview

In addition to producing orthophoto and elevation models PhotoScan may be used to create textured georeferenced 3D models of real objects. You may try to follow this tutorial with your own data or with sample 3D model of ruined milk farm which is heritage object located in north part of St. Petersburg (Russia). The model was generated in PhotoScan Pro based on images taken with a camera installed on quadcopter.

Sample data is available from the following link: ftp.geoscan.aero/public/Sputnik_demo/house_3D.zip (13 Mb). Save file and unpack it.

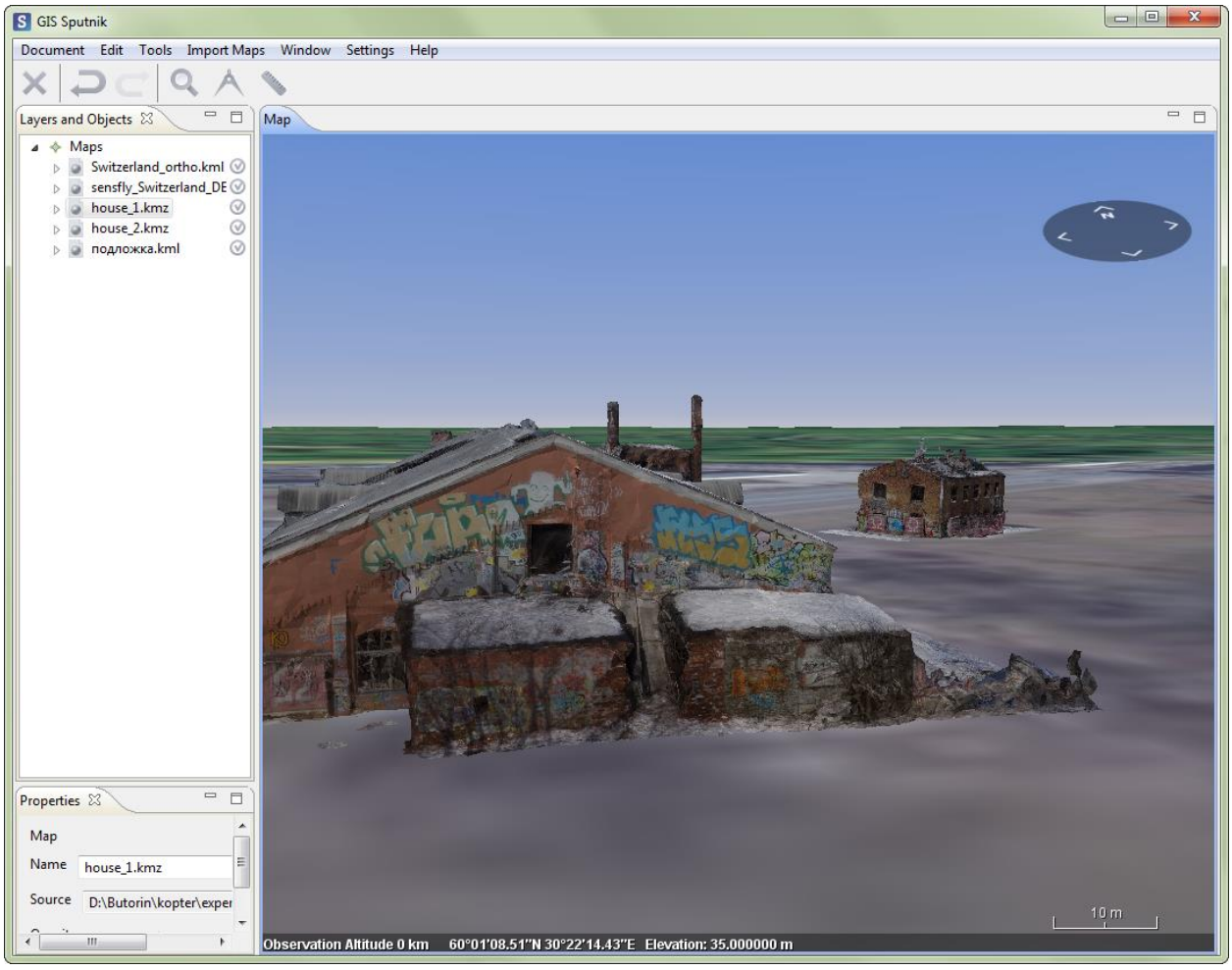
Workflow

3D models are loaded in the same way as maps and elevation models:

- Select **Import Maps** > **KML**, then choose file house_1.kmz from unpacked sample dataset.
- When model is loaded new layer appears in "Layers" pane.
- To display model double click on its name in layers list.

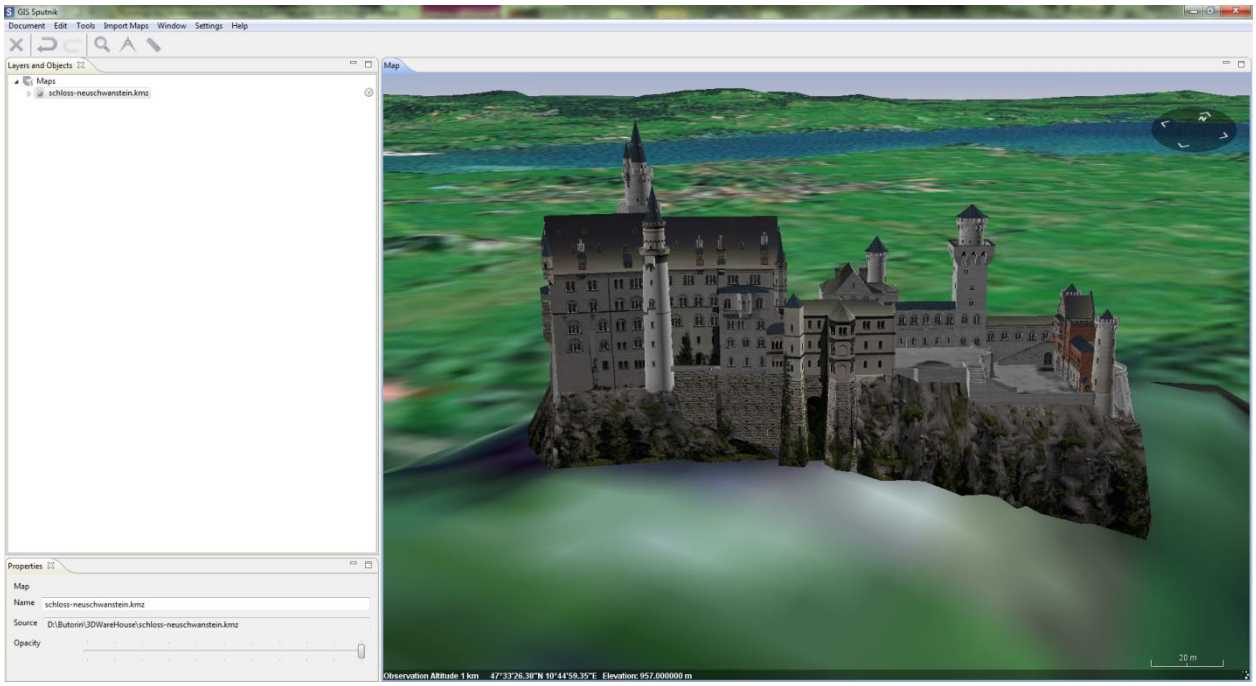
Use navigation options to change viewing angle and position.

Repeat procedure to load another file house_2.kmz. That will bring a neighboring building on a map.



It is also possible to load 3D designed models. Let's take, for example a model from 3dwarehouse (http://www.sketchup.com/products/3D-warehouse):

- go to http://sketchup.google.com/3dwarehouse/details?mid=be26635c5be9f21b9b9685fd76f6c85&prevstart=0.
- Select **Download Model** > **Google Earth 4 (.kmz)**.
- Save schloss-neuschwanstein.kmz file on your computer.
- Load it into Sputnik:

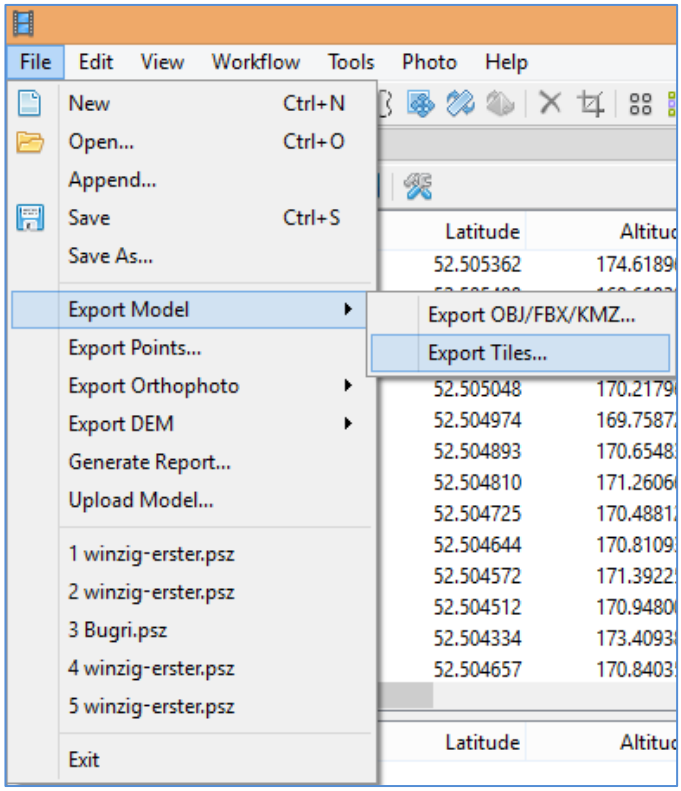


TLS support in GIS Sputnik

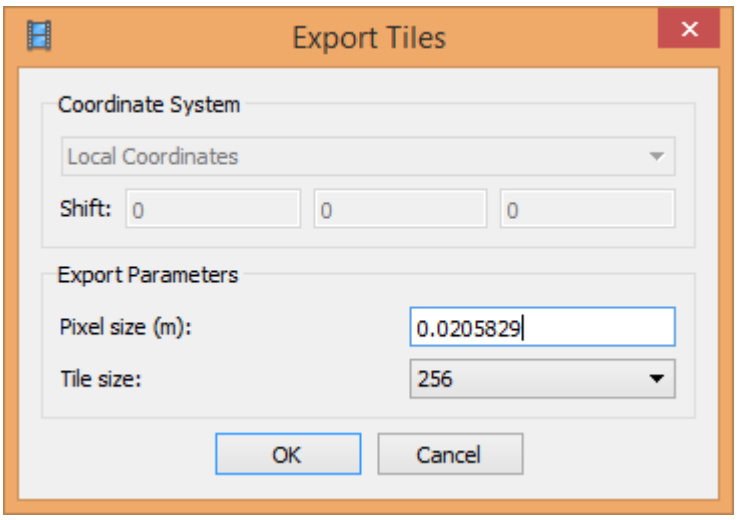
Sputnik GIS supports the Agisoft PhotoScan *.tls format for tile models. Tls format is implemented in Agisoft PhotoScan version 1.1.0 build 1976 and later versions.

To export model in tls format from Agisoft PhotoScan follow the next steps:

- Select **File →Export Model → Export Tiles**…



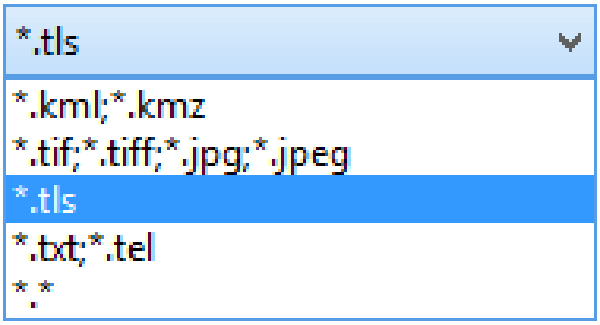
- Specify the **Export Tiles** parameters in the appeared window



- Select the destination folder and name the file, model will start exporting in tls format

To download the resulting model in Sputnik GIS, select **Document → Open** on the main pane and choose the tls format in the appeared window

Only models in WGS84 can be downloaded.



Connection to WMS servers

Overview

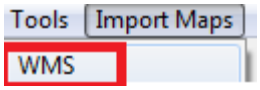
WMS is the most common protocol used to make maps available via intra- or internet. Number of free available maps including Open Street Map (OMS) and satellite imagery are distributed as WMS service. This tutorial describes how to connect to WMS servers.

First:

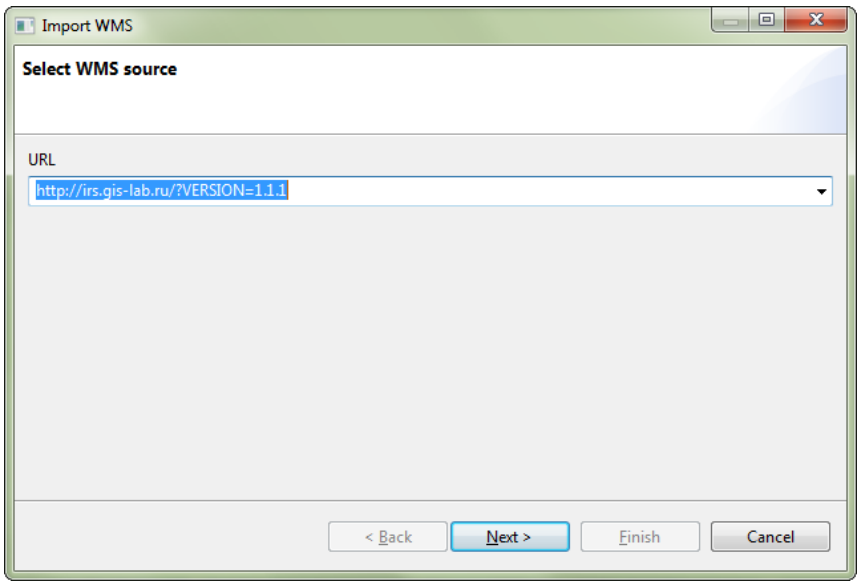
- Make sure you have broadband internet connection.
- Check that website http://irs.gis-lab.ru/?VERSION=1.1.1 is available.

Setting connection

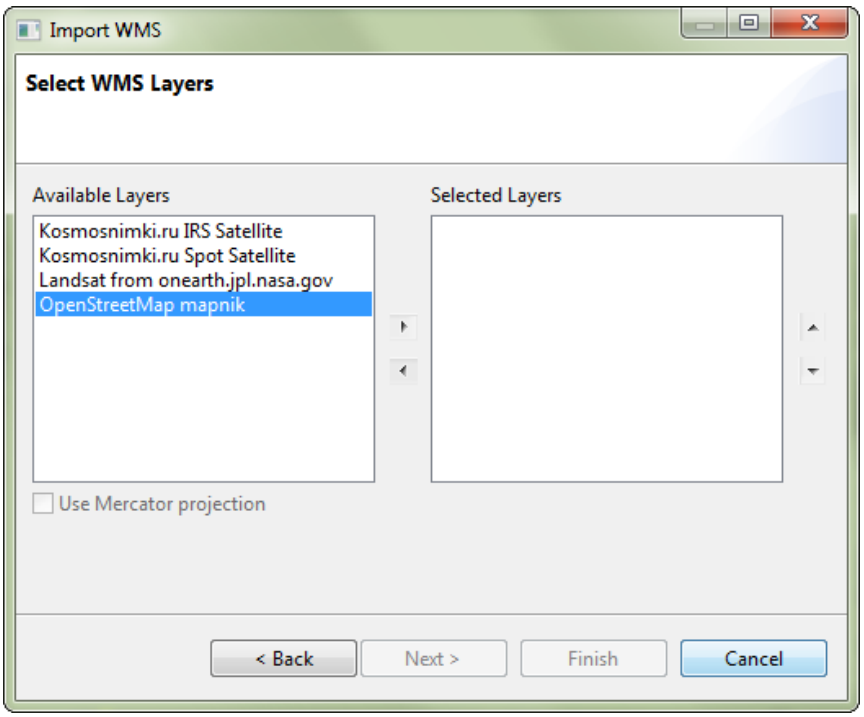
- Select **Import Maps** > **WMS** in user menu.



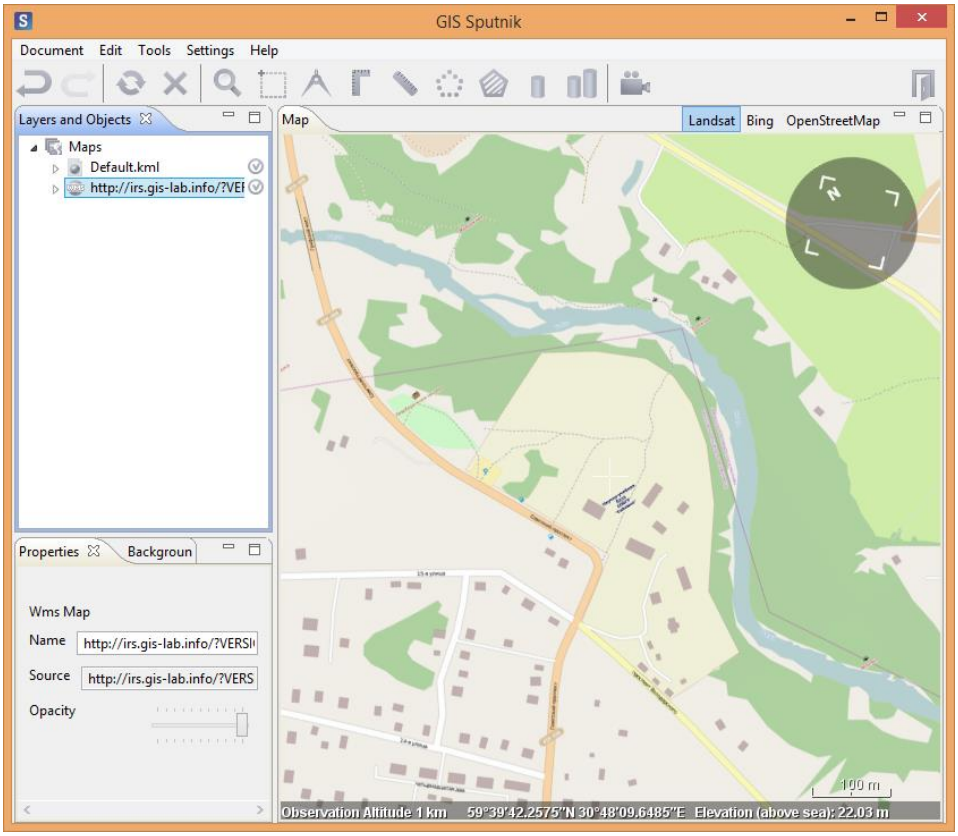
- Input address of known WMS server, for example http://irs.gis-lab.info/?VERSION=1.1.1:



- When list of layers provided by this server is loaded, select layers you want to have on a map (use arrow buttons or double click on layer name to move it to “Selected” list):

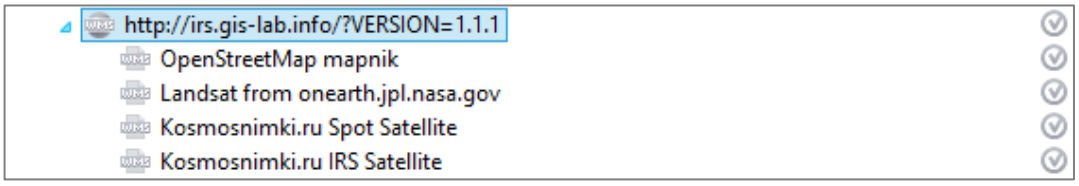

Import WMS
Select WMS Layers
Available Layers
Kosmosnimki.ru IRS Satellite
Kosmosnimki.ru Spot Satellite
Landsat from onearth.jpl.nasa.gov
OpenStreetMap mapnik
Selected Layers
Use Mercator projection
< Back
Next >
Finish
Cancel

- Press **Finish** button.



As a result selected layer will be displayed on a map.

If several layers were selected they will form a group:



In a similar way data may be added from any OGC-compliant servers, including ArcGIS, Geoserver (www.geoserver.org) and others.

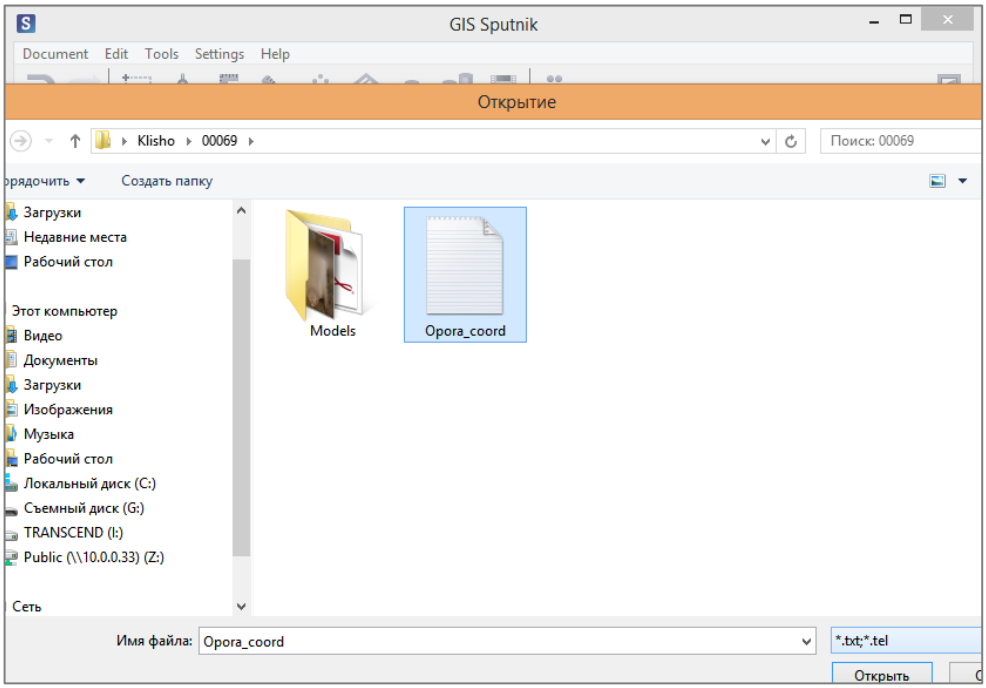
Generating PhotoScan project file

Overview

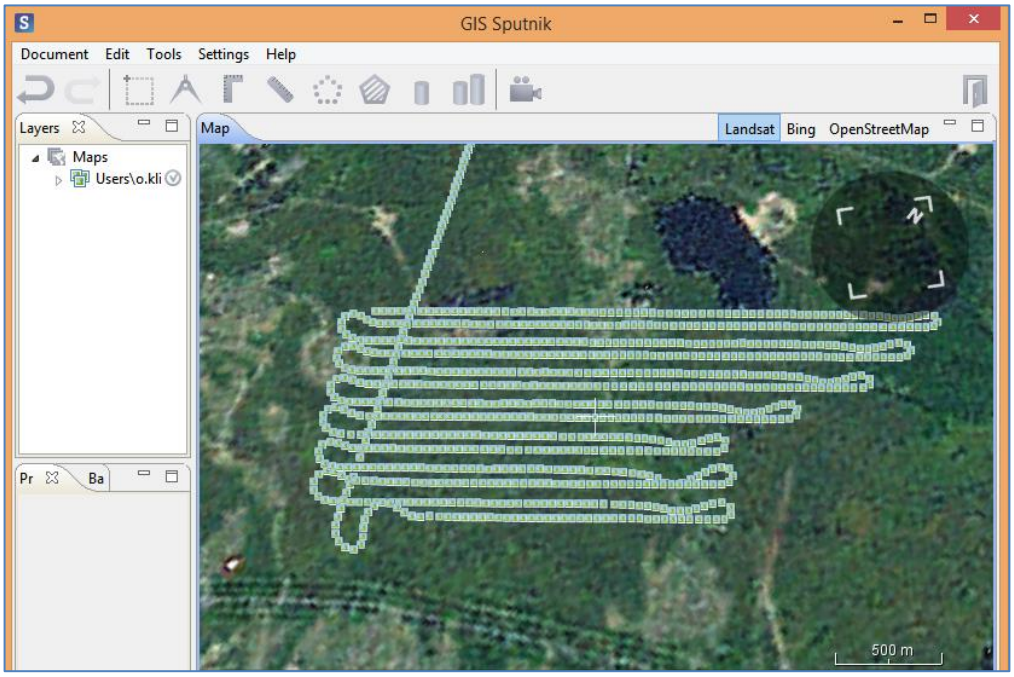
In GIS Sputnik you can inspect flight's track importing file with camera's coordinates in *.txt or *.tel formats. Moreover, determining zone of interest, it is possible to generate PhotoScan project file straight away.

To visualize track follow steps:

- Select **Documents** > **Open** on the top pane, then choose **.txt, *.tel* file format in the scroll pane of *Opening* window and select file of interest



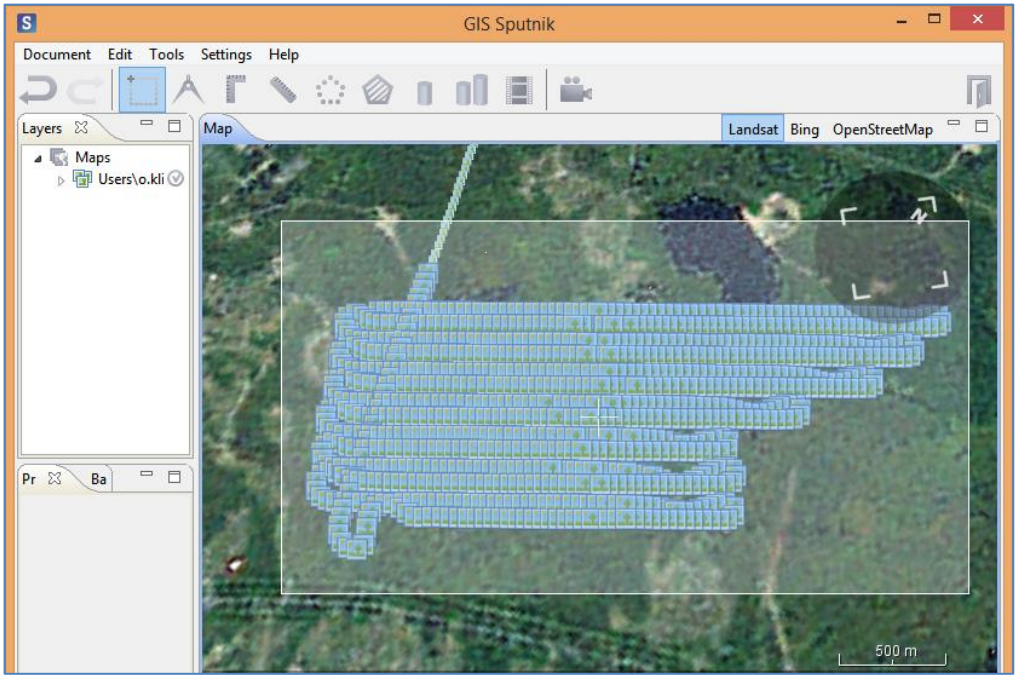
- Selected file with camera's coordinates will be visualized like a UAV's flight track . To open the photograph, double click the camera icon.



To generate the PhotoScan project file follow the next steps:

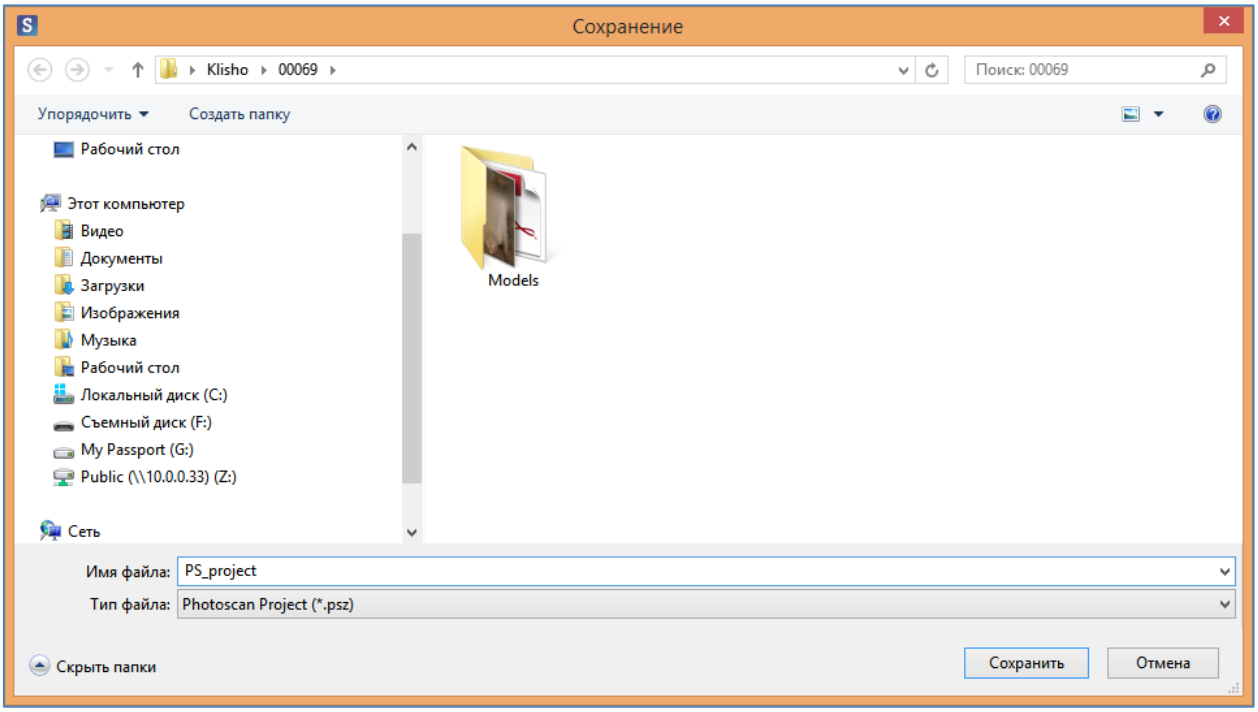
- Open **.txt* or **.tel* file with camera's coordinates like it was described above
- Select **Rectangular selection** button on the top pane

and determine the cameras of interest with the rectangular selection zone:



- Press **Export to PhotoScan** button on the top pane

- PhotoScan project saving dialog will be opened, select the containing folder and name of the project



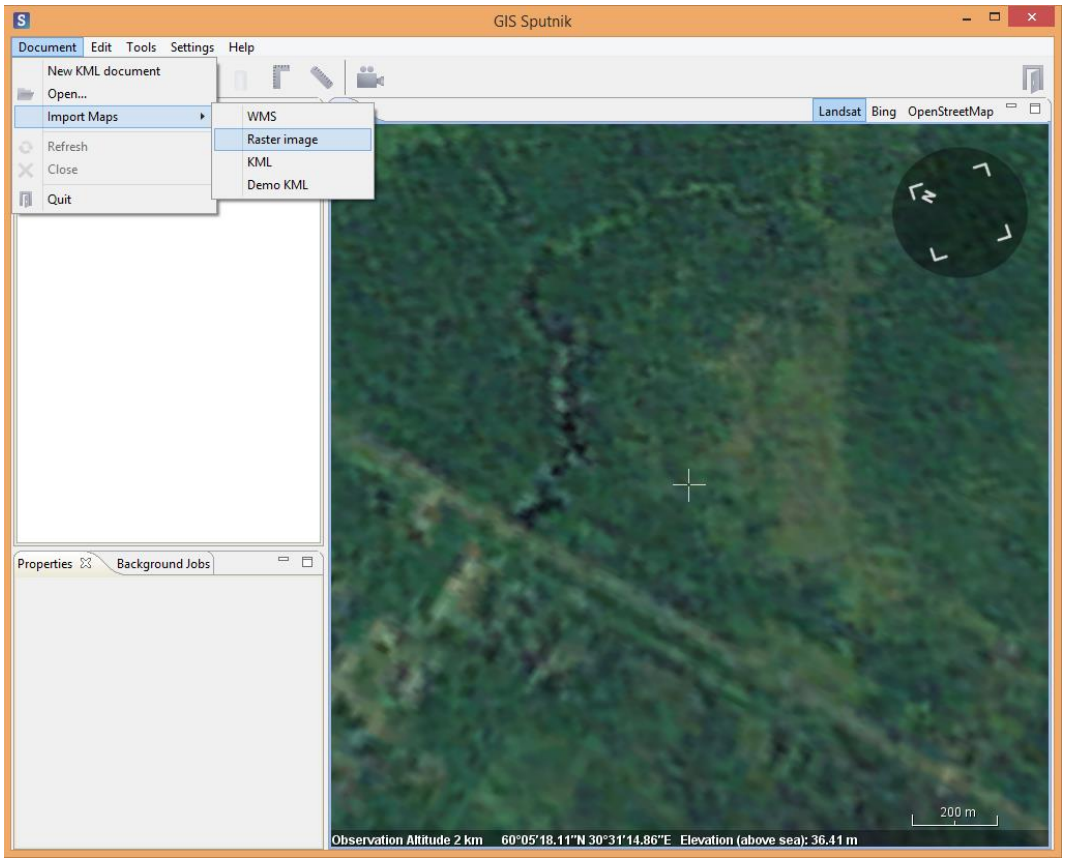
Consequently PhotoScan project file will be automatically generated. Selected cameras will be included in one chunk of the created project.

GeoTIFF support in GIS Sputnik

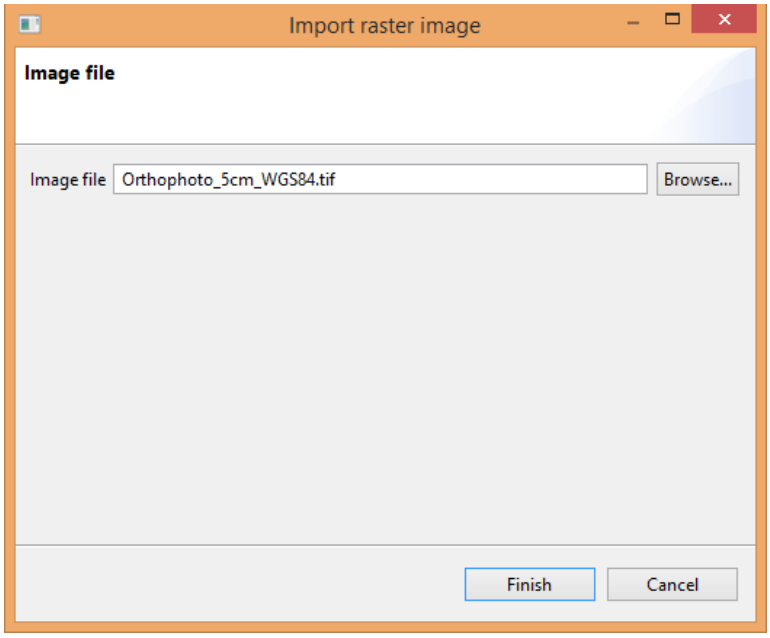
It is possible to open GeoTIFF files in GIS Sputnik.

To open the raster file of interest follow the instructions:

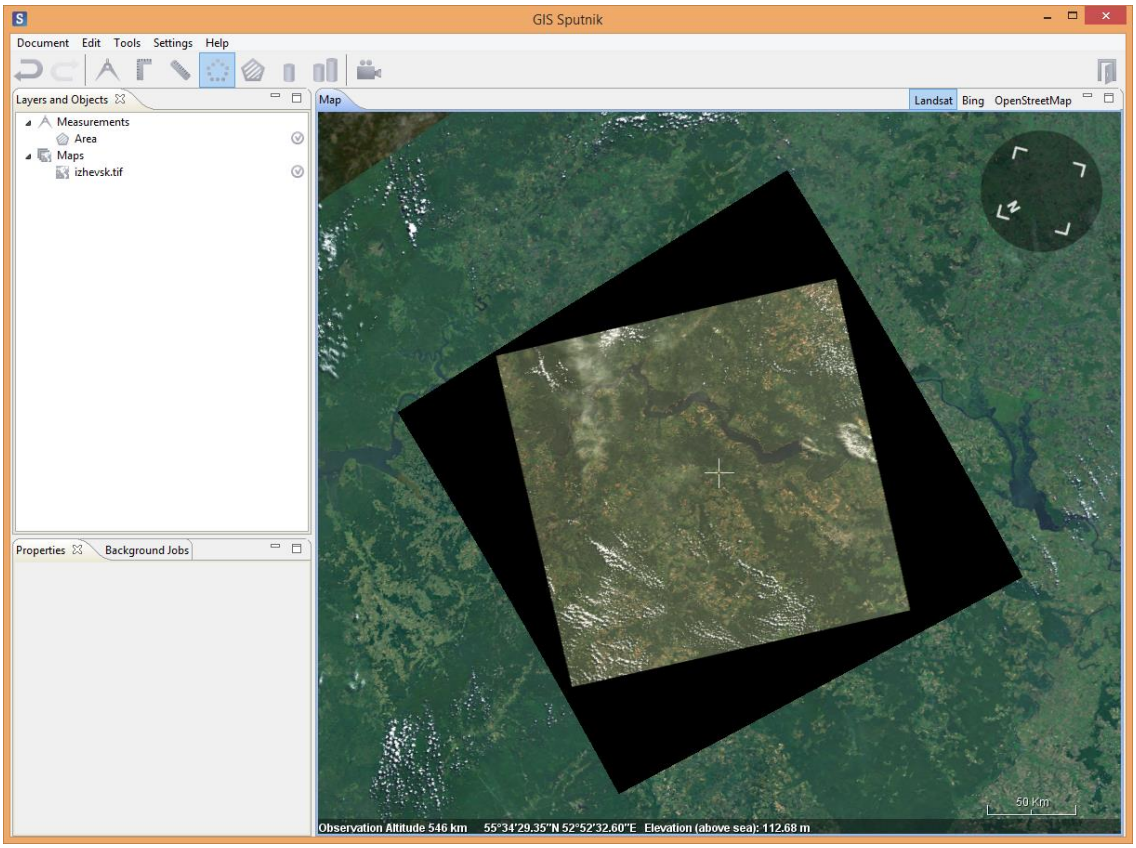
- Select **Document** → **Import Maps** → **Raster Image** on the top panel



- Select the raster of interest in the emersed window



- Selected file will automatically be shown in the *Layers and Objects* list and visualized in *Map* window:



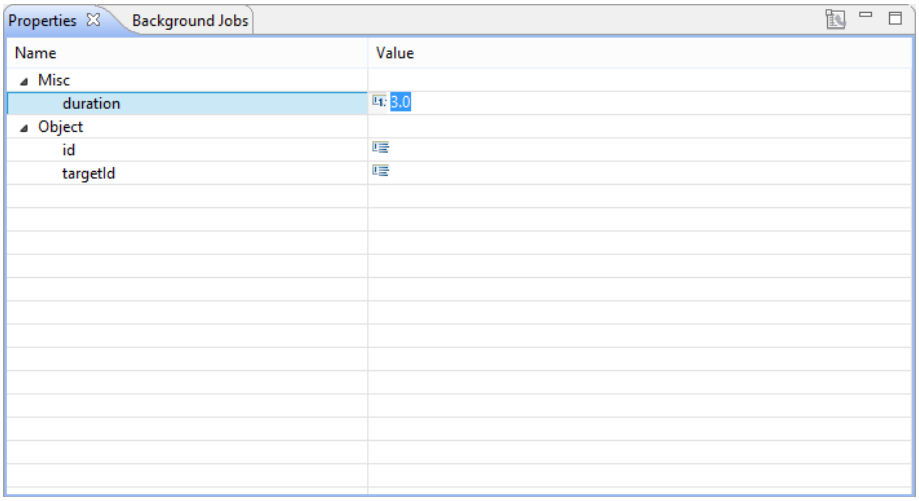
Tours recording in Sputnik

Tour tool in GIS Sputnik gives you the ability to create the demonstrations and presentations/

To start a tour:

- Press “save observer’s position” on the tool panel, that will create the Tour object in “layers and objects” pane and record current position
- Add view positions successively pressing and pauses - using button on the tool panel. This creates corresponding elements within active Tour.

To define the pause duration select wait element in the list and edit duration field (in Properties pane):



You can also change the sequence of positions and pauses dragging them in the list.

To play the tour:

- Select Tour of interest in the “layers and objects” list
- Press button. Press to pause.

Sample dataset

- ftp.geoscan.aero/public/Sputnik_demo/Volume/avtodor_dem1.kmz (197 Mb)
- ftp.geoscan.aero/public/Sputnik_demo/Volume/avtodor_ortho.kmz (142 Mb)
- ftp.geoscan.aero/public/Sputnik_demo/Volume/Tour.kmz (4 Kb)

TROUBLESHOOTING

If **Map** window is not displayed (grayed out), please download the latest version of Java from Oracle website:
http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html

Then reinstall Sputnik.

Please be aware that Sputnik and Java versions must correspond to system type (64-bit or 32-bit).

With any questions on Sputnik purchase and technical support please contact us via e-mail: sputnik@geoscan.aero.

Geoscan team
web: www.geoscan.aero

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